

## CLAIMS

What is claimed is:

1. A power supply apparatus for a motor including an AC power supply, a diode rectifier circuit to rectify power of the AC power supply and a DC capacitor to smooth the rectified power, comprising:
  - a current limiting part provided between the AC power supply and the DC capacitor;
  - a connection switching part to switch a connection state of the diode rectifier circuit and the current limiting part; and
  - a controller to control the connection switching part so that the diode rectifier circuit and the current limiting part are connected to each other selectively in parallel or in series.
2. The power supply apparatus for the motor according to claim 1, further comprising:
  - a detecting part to detect voltage applied between first and second end parts of the DC capacitor.
3. The power supply apparatus for the motor according to claim 1, wherein:
  - the current limiting part comprises:
    - a resistor provided between the AC power supply and the DC capacitor and connected to the DC capacitor; and
    - the connection switching part comprises:
      - a relay having a first contact point and a second contact point to allow the diode rectifier circuit and the resistor to be connected to each other selectively in parallel or in series, and the controller controls the relay to connect the diode rectifier circuit and the resistor in series when the power is supplied initially, and to connect the diode rectifier circuit and the resistor in parallel when the voltage applied between the first and second end parts of the DC capacitor is more than a predetermined voltage.

4. The power supply apparatus for the motor according to claim 2, wherein:  
the current limiting part comprises:

a resistor provided between the AC power supply and the DC capacitor and  
connected to the DC capacitor; and

the connection switching part comprises:

a relay having a first contact point and a second contact point to allow the diode  
rectifier circuit and the resistor to be connected to each other selectively in parallel or in series,  
and the controller controls the relay to connect the diode rectifier circuit and the resistor in series  
when the power is supplied initially, and to connect the diode rectifier circuit and the resistor in  
parallel when the voltage applied between the first and second end parts of the DC capacitor is  
more than a predetermined voltage.

5. The power supply apparatus for the motor according to claim 3, further  
comprising:

an over voltage protection switching part connected to the resistor and provided in  
parallel with the diode rectifier circuit; and

an over voltage protection diode having an anode connected to a contact point of the  
resistor and the over voltage protection switching part, and a cathode connected to the diode  
rectifier circuit.

6. The power supply apparatus for the motor according to claim 4, further  
comprising:

an over voltage protection switching part connected to the resistor and provided in  
parallel with the diode rectifier circuit; and

an over voltage protection diode having an anode connected to a contact point of the  
resistor and the over voltage protection switching part, and a cathode connected to the diode  
rectifier circuit.

7. The power supply apparatus for the motor according to claim 4, wherein the  
detecting part comprises:

a comparator so as to detect the voltage applied between the first and second end parts of the DC capacitor.

8. The power supply apparatus for the motor according to claim 6, wherein the detecting part comprises:

a comparator so as to detect the voltage applied between the first and second end parts of the DC capacitor.

9. A control method of a power supply apparatus for a motor including an AC power supply, a diode rectifier circuit to rectify power of the AC power supply, a DC capacitor to smooth the rectified power, a resistor connected to the DC capacitor and a two-contact relay to allow an end part of the diode rectifier circuit selectively connected to one of first and second end parts of the resistor, comprising:

connecting the diode rectifier circuit to the resistor in series so as to charge the DC capacitor when power is supplied initially;

detecting voltage applied between first and second end parts of the DC capacitor; and

connecting the diode rectifier circuit to the resistor in parallel when the detected voltage is more than a predetermined voltage.

10. A power supply apparatus for a motor including an AC power supply, a rectifier circuit to rectify power of the AC power supply and a smoothing circuit to smooth the rectified power, comprising:

a current limiting part provided between the AC power supply and the smoothing circuit; and

a connection switching part to switch a connection state of the rectifier circuit and the current limiting part so that the rectifier circuit and the current limiting part are connected to each other selectively in parallel or in series.

11. The power supply apparatus for the motor according to claim 10, wherein the smoothing circuit comprises:

a DC capacitor to smooth the AC rectified power, and the power supply apparatus,

further comprising:

a detecting part to detect voltage across the DC capacitor of the smoothing circuit.

12. The power supply apparatus for the motor according to claim 10, wherein:  
the current limiting part comprises:

a resistor provided between the AC power supply and the smoothing circuit and  
connected to the smoothing circuit; and

the connection switching part comprises:

a relay having a first node and a second node to connect the rectifier circuit and  
the resistor, respectively and selectively in parallel or in series.

13. The power supply apparatus for the motor according to claim 10, further  
comprising:

a controller to control the connection switching part to switch the connection state of the  
rectifier circuit and the current limiting part so that the rectifier circuit and the current limiting part  
are connected to each other selectively in parallel or in series.

14. The power supply apparatus for the motor according to claim 10, wherein the  
current limiting part comprises:

a resistor to be switched by the connection switching part, and the connection switching  
part comprises:

a relay to connect the rectifier circuit and the resistor in series when the power is  
supplied initially, and to connect the rectifier circuit and the resistor in parallel when the voltage  
between the first and second end parts of the smoothing circuit is more than a predetermined  
voltage.

15. The power supply apparatus for the motor according to claim 14, further  
comprising:

an over voltage protection switching part connected to the resistor and provided in  
parallel with the rectifier circuit; and

an over voltage protection diode having an anode connected to a common node of the resistor and the over voltage protection switching part, and a cathode connected to the rectifier circuit.

16. The power supply apparatus for the motor according to claim 11, wherein the detecting part comprises:

a comparator to detect the voltage across the DC capacitor.

17. A power supply apparatus for a motor including an AC power supply, a rectifier circuit to rectify power of the AC power supply and a smoothing circuit to smooth the rectified power, comprising:

a current limiting part comprising:

a resistor such that the current limiting part is provided between the AC power supply and the smoothing circuit;

an over voltage protection part connected to the resistor and provided in parallel with the rectifier circuit; and

a connection switching part to switch the rectified AC power supply to provide one or more of a current limiting protection and an over voltage protection according to a connection state of the connection switching part.

18. A control method of a power supply apparatus for a motor including an AC power supply; a rectifier circuit rectifying power of the AC power supply and a smoothing circuit having a DC capacitor and smoothing the rectified power, a resistor having first and second ends, one of the ends of the resistor being connected to the DC capacitor having first and second ends and a relay allowing the rectifier circuit to be alternatively connected to one of the first and second ends of the resistor, comprising:

supplying power to the motor;

current limiting the supplied power when the power is supplied initially by connecting the rectifier circuit to the resistor in series;

detecting a voltage across the first and second ends of the DC capacitor; and

switching the rectifier circuit and the resistor to a parallel connection when the detected voltage is more than a predetermined voltage.

19. The control method according to claim 18, further comprising:  
controlling the switching of a connection state of the rectifier circuit and the resistor so that the rectifier circuit and the resistor are connected to each other selectively in parallel or in series.

20. The control method according to claim 18, further comprising:  
protecting the motor from an over voltage condition by connecting an over voltage protection circuit in parallel with the rectifier circuit.

21. The control method according to claim 19, wherein:  
the supplying of power to the motor comprises:  
charging the DC capacitor with current inputted through the resistor; and  
the controlling of the switching comprises:  
applying a control signal to the relay to connect the rectifier circuit and the resistor in series when the voltage across the DC capacitor is less than or equal to a predetermined voltage and to connect the rectifier circuit and the resistor in parallel when the voltage across the DC capacitor is more than the predetermined voltage.